

Study on the Demolition Waste Management in Malaysia Construction Industry

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Abstract — *The Malaysia construction industry generates a large quantity of construction and demolition waste nowadays. In the handbook for demolition work only comprised small portion of demolition waste management. It is important to study and determine the ways to provide a practical guide for the professional in the building industry about handling the demolition waste. In general, demolition defined as tearing down or wrecking of structural work or architectural work of the building and other infrastructures work such as road, bridge and etc. It's a common misconception that demolition is nothing more than taking down a structure and carrying the debris to a landfill. On many projects, 80-90% of the structure is kept for reuse or recycling which help the owner to save cost. Demolition contractors required a lot of knowledge and experience to minimize the impact of demolition work to the existing surrounding area. For data collecting method, postal questionnaires and interviews have been selected to collect data. Questionnaires have distributed to 80 respondents from the construction industry in Klang Valley. 67 of 80 respondents have replied the questionnaire while 4 people have interviewed. Microsoft Excel and Statistical Package for Social Science version 17.0 were used to analyze the data collected.*

Index Terms--- Demolition, Waste Management and Construction Material

I. INTRODUCTION

The Malaysia has undergone a rapid infrastructure development over the last decade as Malaysia undergoing transformation process. Therefore, demolition project has to carry out to provide the site for construction of new buildings. Study of comparison between new construction and refurbishment showed that construction activity will be generated more 80% waste than refurbishment. For some historical city, there is more waste generated due to demolition and new construction project (Teixeira and Couto, 2000).

Besides that, data related total waste generated have been collected from several countries and the results showed that construction and demolition waste have comprised around 20% to 30% of the total waste in landfill. The result also shows the amount of demolition waste is double the amount of construction waste (Bossink and Brouwers, 1996). Construction wastes have become an issue that needs highly concern in many developing countries because it has an adverse effect on economy, environment and social aspects. Nevertheless, the impact of excessive demolition waste will definitely double than the impact from construction waste.

Illegal dumping is a common issue and also a solution for Contractors who dealing with waste in Malaysia (Sasitharan et

al, 2012). Therefore, the generated waste in Malaysia usually ends up in the landfill. From The Star (2010) reported that, landfill has caused social and environmental problems. Due to improper way to handle the waste, the landfill is quickly full with all wastes.

Although there are regulatory policies in Malaysia for handling waste generation including Solid Waste and Public Cleansing Management Act 2007 (PPSPPA) governed by Ministry of Housing and Local Government; Standard Specifications for Buildings Works (SBW) governed by Ministry of Works; Environmental Quality Act 1974 (EQA) governed by Ministry of Natural Resources and Environment; and Pembinaan Malaysia Act 1994 (PMA) governed by Construction Industry Development Board (CIDB), those policies just mainly focus on solid waste (Sasitharan, 2012). There is no regulation, guideline, policy or statues for managing the demolition waste generation in Malaysia.

There is variety of demolition waste from old building but lead paint and asbestos are the most common material that faced by demolition contractors (Missouri Department of Natural Resources, 2008). Studies directed by the U.S. Agency for Toxic Substances and Disease Registry and others independent researchers show that lead exposure will affect human health (Missouri Department of Natural Resources, 2008). Obviously, there are no particular procedures or practices were established to manage demolition waste. The decision making process always based on professional engineer's knowledge and past experiences. Thus, an adequate conclusion about demolition waste management in this country must be determined before the problems arrived.

II. LITERATURE REVIEW

Firstly, the issues of waste generation problem need to be determined early before implemented the waste management plan. Since 1990's, the number of building and infrastructure development projects have significantly increased and led to a growth in construction waste material generation. (Begum et al., 2007). As a result of rapid urbanization, waste management cost has increased as well and landfill site issues have arisen in the country. The Ministry of Housing and Local Government (MHLG) Malaysia has taken the action by encouraging and introduced recycling systems in order to minimize the waste. However, the Malaysian data show that the rate of recycling of solid waste remains at about 2 to 5%. (Ministry Of Housing and Local Government Malaysia, 2006)

Most of the landfills in Malaysian are poor in management. The landfills operate as dumping area without a proper standard system and without suitable treatment facilities to treat those wastes. If the situation still continues with this practice, the landfill will reach the limit by 2015. Furthermore, an

alternative landfill sites are still not available yet. (Agamuthu and Nagendran, 2010).

Poor practice of waste management has caused trouble for the health of people as well as the environment. The Star (2012) reported that contractor has left the construction waste beside the road during a road-upgrading project. The project board left on the road as well. This practice has shown the poor waste management skills of those irresponsible contractors.

The issues on waste minimization of the construction waste need to be study first to eliminate barriers that slow down the process of waste minimization in order to carry out demolition waste management plan. Ministry of Housing and Local Government Malaysia (2006) has mentioned that there are five major issues that need to be concerned:

- I. Increase in term cost and quantity of solid waste need to be handled. The amount of waste generated is significantly increased due to heavy urbanization and increased population. In 2004 an estimated 8.7 million tons of municipal waste were generated. With the current trend continued, the quantity of waste is expected to reach 15.7 million tons in 2020. Meanwhile, the cost to manage the waste will be increase along with the amount of waste generated.
- II. Limited information for waste management plan the government is mainly counting on the helps from local authorities for collecting the solid waste management database. The requirements and the procedures to collect the data is not standardized. In particular, the data on solid waste generated from construction or demolition activities is very limited.
- III. Lack of awareness of waste minimization program Although the government has put effort on raising awareness on recycling for a long time, the general public does not influence by the program. The general public is more focus on the segregation and selling of those valuable materials. Therefore, the awareness program should mainly focus on resource scarcity and the effect of lack waste minimization on their next generation.
- IV. Good practice waste Minimization and management (WMM). The primary aims of good practice WMM is to deliver the best material resource efficiency and minimize the amount of waste required to send to landfill. By implementing the waste hierarchy to reduce, reuse, recycle, recover and dispose the waste, this can help to reduce the waste generated by demolition. By using the concepts of waste hierarchy and implement waste minimization practice during the project, it can increase the efficiency of waste management then reduce the waste generated (WRAP, 2011).

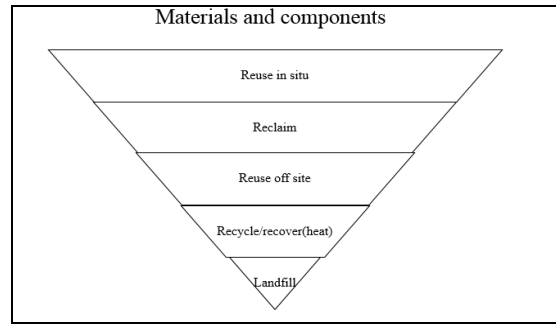


Fig.1. Waste Hierarchy. (Source: Institution of Civil Engineers, 2008)

Throughout waste minimization, this will minimize the impact of the social and environmental. The last effort to minimize the waste generated is disposed the waste to the landfill when the alternative choice cannot be worked out. However, not all theories in the waste hierarchy can be used in the construction and demolition work. Reduce reuse and recycle will be the appropriate method can be used. Without a proper management plan, the theory mentioned from Figure 1 cannot be implemented.

III. METHODOLOGY

For the purpose of the study, basically discusses the research method that has been used to carry out this study. Choosing the correct research method is the priority in order to achieve the targeted objective. The step to verify the theories from the literature review in chapter 2 is carrying a field survey which is collecting data and information from targeted parties such as engineers and contractors. The method of data collection and tools for analysis the data will be explained in this chapter. The data and information from interviews and questionnaires will be the primary data in this study. Tools for analysis the relevant data will be selected precisely in order to show the information. All information will be arranged and compounded before started to analysis. There will be certain difficulties and obstacles will affect the work of collecting data. The possible problems that may encounter will be identified and remedial action will be taken.

A. Research Strategy

Research strategy can be defined as the way implemented which the research objective can meet the actual result. There are two ways of research strategies namely quantitative and qualitative research. Few elements need to consider before deciding the type of research to be carried out such the purpose of study and the type and availability of the relevant information which is required.

Quantitative research is defined as a study into the human or social problem faced by current community. It is based on questioning a hypothesis or a theory comprised of few variables, measured with numbers and analysis with statistical procedures to verify these theories (Naoum, 2007) Therefore, Naoum (2007) mentioned that the quantitative data can considered hard and reliable due to the data all can be measured. Meanwhile, Qualitative research is based on the

experiences and opinions of the person, descriptions and the meaning of the theory which seem to be very subjective. The qualitative data can be rich and deep. Due to the complexity of the data, the data may be difficult to analyze and interpret. Thus, Quantitative research method is chosen for this study as the objectives required support from the fact.

IV. RESULT

The data collected from the survey questionnaires will be analyzed by using the Microsoft Excel and SPSS. The results will be presented in an appropriate form of table, bar chart, pie chart, histogram, line chart, and the like. Based on the data collected, discussions, ideas and comments will be made to criticize and support the research topic. Besides, data collection from interview will be analyzed and discuss in this chapter.

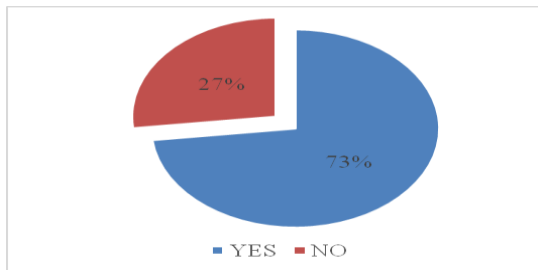


Fig 2 Severity of construction and demolition waste problem in Malaysia

From the Figure 2, it showed 73% of the 67 respondents are agreed that the construction and demolition waste are a problem in Malaysia for the current situation and also probably will affect future generations. There is a common practice in Malaysia that will relate the demolition waste to construction waste as the fault of constructed work done will need to be demolished. Sometimes, they will classify that demolition waste as construction waste as well. This is because the amount demolition work is significantly less than the amount of construction work.

However, the way of handling construction waste will indirectly related to the demolition waste since they compound are nearly same. Besides that, the demolition work is not only occurring for old or historic building but also happened to common residential housing development. The trend of Malaysian will do for their new house is carried out renovation by demolishing the entire wall and extend their house. These wastes can consider as demolition waste as well. The amount of demolition waste will double than the amount of construction waste. There is only 27% of respondents disagree with this statement as some of them did not implement a waste management plan at their site. Thus, there is no doubt that demolition waste will become an issue in the future.

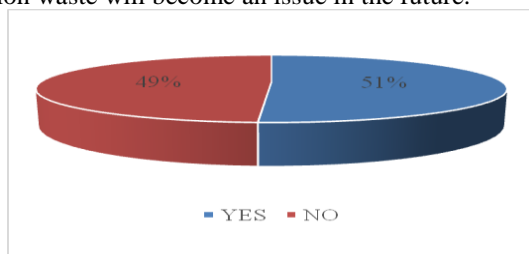


Fig 3 Implementation of Waste Minimisation Program

Referring to the figure 3, there is 51% of the respondents do involved in the waste minimization programs while 49% of them are not involved in waste minimization program. The gap between “yes” and “no” just only 2 percent which show the waste minimization program still remain in a development stage. The statement cannot mention that the construction industry already fully carries the waste minimization program or the implementation of waste minimization program is slow.

The reason for implementing the waste minimization because of the benefits can be obtained from carry out the waste minimization practices. Meanwhile, the reason of not implementing the waste minimization practice is because the barriers or obstacles that existed during the process of implementation.

However, there is already waste minimization practice have been carried out by more than half of the respondent’s company. Therefore, we must identify the barriers that discourage the implementation of the waste minimization practices. There sure is no problem of managing the demolition waste as those barriers have been removed.

Table 1 Type of demolition waste generated in Malaysia Construction Industry

	N	Range	Min	Max	Sum	Mean
C	67	4	1	5	265	3.96
TB	67	3	2	5	262	3.91
B	67	3	2	5	253	3.78
M	67	3	2	5	231	3.45
AG	67	4	1	5	227	3.39
FM	67	4	1	5	224	3.34
WC	67	4	1	5	218	3.25
AB	67	4	1	5	210	3.13
NFM	67	4	1	5	208	3.10
FF	67	4	1	5	172	2.57
Valid N (listwise)	67					

According to the Table 1, it showed type of demolition waste generated in Malaysia construction industry the top three common demolition waste generally will find at the site are concrete, timber and brick. The means of the respondents selected these three materials are 3.96 for concrete, 3.91 for timber and 3.78 for brick. Concrete definitely will be the highest amount of waste generated at the site as the building constructed in Malaysia construction industry comprised a huge amount of concrete usage. Concrete is implemented as its cost will be cheaper to construct for structural work if compare to steel.

Meanwhile, there are many old buildings constructed with concrete, timber and brick in Klang Valley. Some of the old buildings exist before the nation has get independence. The design style of building is followed the old fashion. Therefore during demolition of those buildings, massive amount of concrete, timber and brick are generated. However, those materials usually cannot be used due their specification did not

reach the current standard provided. For those means of other materials are following; 3.45 for metal, 3.39 for aggregate, 3.34 for ferrous metal, 3.25 for wiring and conduit, 3.13 for asphalt and bitumen, 3.10 for non-ferrous metal and 2.57 for furniture and fitting.

The three scored lowest mean material are asphalt and bitumen, non-ferrous metal and furniture and fitting. For road construction in Malaysia, there is a less demolition of road work in order to replace new road. Layer and layer of asphalt and bitumen will only keep adding on the old road. Non-ferrous metal and furniture and fitting usually will get stolen before the demolition contractor carry out the demolition work. Therefore, the amount of these wastes generated only take a small portion of the overall waste amount.

Table 2 Demolition Waste Management Plan

	N	Minimum	Maximum	Sum	Mean
M	67	1	5	273	4.07
P	67	2	5	269	4.01
FS	67	2	5	264	3.94
STO	67	1	5	254	3.79
PAD	67	2	5	253	3.78
RV	67	1	5	246	3.67
RU	67	1	5	238	3.55
Valid N (listwise)	67				

From table 2 it showed the plans are prepared for solving the problem caused by the demolition waste and also helping to emphasize the demolition waste management. Although there are many plans available, three most effective strategies has selected by the respondent. Most respondents have selected strategy to carry out monitoring work during the demolition work started which scored mean of 4.07. This strategy has the highest mean rating among other strategy.

Monitoring work is important in term of cost and quality of the demolition work. During the demolition stage, many wastes are generated and valuable waste need to segregate carefully because some of them able to reuse or recycle. Those valuable materials need to be stored in a secured place to prevent theft. Any incident or amount of waste needs to record during the monitoring work to ensure the quality of work. At the mean time of monitoring the work, the workmanship of the labour need to take care as well. Although Contractor will carry the monitoring work, another party member should participate in the monitoring work together to ensure the waste management plan has fully implemented. The second plan that recommended by the respondent and gets the second highest mean of 4.01 among other plans is establishing an overall policy. Without a policy set by the top management of the organization, there is no reason for the medium and bottom management staff to carry out the waste minimization practice as the organization did not show any intention or determination.

Therefore, a policy able to become a guideline or procedure which makes people to carry out a task with an objective. For example, the target for the amount of waste generated to be reduced in every project. With an objective, it can lead the team to achieve the target with the proper intention. However, the

objective and requirements of the project need to determine throughout the feasibility study which also get the third highest score of 3.94. Setting up a store and carry out pre-demolition audit has scored mean of 3.79. Reviewing of the action plan scored the second lowest mean of 3.67. The lowest score is the reuse of demolition waste due to limited technology and knowledge.

Table 3 Demolition Waste Management Plan

	N	Minimum	Maximum	Sum	Mean
CON	67	1	5	284	4.24
DV	67	2	5	266	3.97
DE	67	1	5	264	3.94
SS	67	1	5	263	3.93
Valid N (listwise)	67				

From the Table 3, it showed the statement of the contractor should choose a proper demolition method and monitoring the work during the demolition work (CON) has gotten the first rankings which get a mean of 4.24. The contractor is holding the right to decide on the method of demolition instead of fully follow the design or instruction from the designer. That is the reason where the contractor is playing an important role to ensure the waste minimisation practice can be successfully carried out. The contractor has to decide the correct method for carrying out demolition work as the method will indirectly affect the amount of waste generated as well as the amount of waste that can be reused or recycle.

Furthermore, without proper monitoring has carried out on the demolition work and the method of handling those wastes generated, the waste minimisation practice will not be carried out properly. This is because poor workmanship and low morale of the workers. However, the contractor has to take steps to ensure that the quality of the work flow and action plan needs to prevent any contingencies occur. The other statements about the roles of Architect and Engineer (DE), Developer and Project Manager (DV) and Site Supervisor (SS) just having an agreement from the average mean of 3.9. But those means do not show that the other party is not important as a Contractor. In real practice, cooperation and teamwork is the key in order to achieve the target. All parties should be sharing their knowledge and resources in order to carry out the waste minimisation practice.

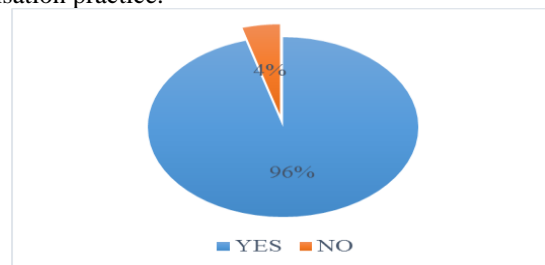


Fig 4 Key Performance Indicators Improve overall Waste Management Plan

Key performance indicators can help improve the overall waste management plan. According to the figure 4, it showed 96% of the respondents are accepting that the statement is workable while only 4% of the respondents have a different opinion on this statement. The high percentage of “YES” has proved that the usefulness and importance of the key performance indicators.

Key performance indicators can help the organization to achieve their target easier as it provides a clear and achievable target. However, the key performance indicators are different for each project. They are decided based on type, size and complexity of the building as well as passed waste management records and data. With correct and proper key performance indicators, it will significantly help the project team to reduce the amount of waste generated as well as the cost of handling waste. The key performance indicator usually used for the organization who handles demolition work on a huge and complex building. Nevertheless, this method still applying for those small projects such demolition work for residential building renovation.

Granted, key performance indicators help the organization to perform effectively and efficiently in managing demolition waste but the key performance indicators need to keep reviewing and revise in order to set the targets.

V. CONCLUSION

Construction waste and demolition waste both are waste that's generated within the construction site. The differences between both wastes are the process of construction work and demolition work. Demolitions work just the reserve version of the construction work. However, demolition waste usually will generate twice more than the construction waste .In order to minimize the demolition waste, it is essential to start with identification of valuable waste and invaluable waste. The main reason is because high amounts of demolition waste will lead to an increment of cost in term of handling waste. With the knowledge of demolition waste management, it might help the contractor to gain profit by selling those valuable wastes for reuse or recycle. In order to achieve the aim of research which may become an important sector in the future? Based on recent research demolition waste just refers to the unwanted waste that generated from the demolition work. However, there is no specified that the waste generated from residential, and commercial .Accordingly are proposed future recommendations for research and studies that can be related to these studies.

- i. Policy statement for demolition waste management
- ii. Demolition waste from renovation work
- iii. Industrialized building system (IBS)

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